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DOBITCI MIMO SUSTAVA SA STANOVIŠTA OBRADE SIGNALA

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Da bi se što bolje iskoristili svi stupnjevi slobode koje nude MIMO sustavi, potrebno je prepoznati i vrednovati moguće dobitke koji se mogu očekivati od MIMO obrade signala. U ovom radu su izvedeni postupci vrednovanja dobitka antene, dobitka diverzitija te dobitka multipleksiranja MIMO sustava. Pokazana je nemogućnost istovremenog maksimiranja sva tri dobitka ili bilo kojeg para dobitaka. Prikazan je nužni kompromis među pojedinim dobitcima sustava.

(Sl. 3, Lit. 19 – original na engleskom) *Autori*

mjera kvalitete MIMO sustava
dobitak antene
dobitak diverzitija
dobitak multipleksiranja

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GENETSKA OPTIMIZACIJA ROJA: EVOLUCIJSKI ALGORITAM ZA DIZAJN ANTENA

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U radu je predstavljen novi efektivni optimizacijski algoritam nazvan genetska optimizacija roja (GSO). To je hibridni algoritam s ciljem da efektivno kombinira svojstva dva najpopularnija evolucijska optimizacijska algoritma, optimizacija roja čestica (PSO) i genetski algoritam (GA), u svrhu optimiziranja elektromagnetskih struktura. Novi algoritam je u principu i PSO i GA, populacijski zasnovana heuristična tehnika pretraživanja, koji može biti korišten za rješavanje kombinatornih optimizacijskih problema modeliranih na osnovi koncepta prirodne selekcije i evolucije (GA) kao i na osnovi kulturnih i socijalnih pravila proizašlih iz analize inteligencije počela i iz međudjelovanja čestica (PSO). Rezultati preliminarne analize prikazani su u radu i uspoređeni s ostalim optimizacijskim tehnikama na klasičnim optimizacijskim problemima.

(Sl. 11, Tab. 1, Lit. 16 – original na engleskom) *Autori*

evolucijski optimizacijski algoritmi
hibridne metode
strategije
reflektorski antenski nizovi

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SMANJENJE SPREGE IZMEĐU DVIJU PLANARNIH OBRNUTIH-F ANTENA S PODRUČJEM RADA U BLISKIM FREKVENCIJSKIM POJASIMA

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U radu je predstavljeno rješenje smanjenja sprege dviju planarnih obrnutih-F antena (PIFA) s područjem rada u bliskim frekvencijskim pojasima: DCS1800 (1710–1880 MHz) i UMTS (1920–2170 MHz). Antene su postavljene u vrh uzemljene ravnine čija je veličina predstavnik tiskanih pločica (PCB) tipičnih mobilnih telefonskih uređaja. Tri antene su konstruirane i nekoliko modifikacija je proučavano, posebice u vezi postavljanja neaktivne prijenosne linije između njih. Ta prijenosna linija je zamišljena da služi kao neutralizirajuća komponenta i da stoga smanjuje međusobnu spregu. Nekoliko prototipova je izvedeno i izmjereno u cilju verifikacije predloženog rješenja.

(Sl. 11, Lit. 11 – original na engleskom) *Autori*

planarna obrnuta-F antena (PIFA)
male antene
sprega
izolacija
mobilna telefonija, efikasnost

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OPTIMIZACIJA ULTRA-ŠIROKOPOJASNIH DIPOL-ANTENA

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Ovaj rad opisuje optimizaciju planarnih ultra-širokopojasnih dipol antena, koje su optimizirane za savršenu prilagodbu impedancije i savršena obilježja zračenja impulsa. Optimizacija oblika dipola počinje na klasičnim širokopojasnim dipolima, posebno onih eliptičnog oblika i oblika kristala dijamanta. Ti su širokopojasni dipoli analizirani i optimizirani s nezadovoljavajućim performancama parametara. Stoga su u ovom radu predložene dvije optimirane dipole strukture zadovoljavajućih performanca. Projektirane se antene mogu upotrijebiti kao filtri za oblikovanje impulsa u ultra širokom pojasu frekvencija.

(Sl. 13, Tab. 1, Lit. 5 – original na engleskom) *Autori*

antene
ultra široki pojas
zračenje impulsa
eliptični dipol
dijamantni dipol

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GENETICAL SWARM OPTIMIZATION: AN EVOLUTIONARY ALGORITHM FOR ANTENNA DESIGN

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In this paper a new effective optimization algorithm called Genetical Swarm Optimization (GSO) is presented. This is an hybrid algorithm developed in order to combine in the most effective way the properties of two of the most popular evolutionary optimization approaches now in use for the optimization of electromagnetic structures, the Particle Swarm Optimization (PSO) and Genetic Algorithms (GA). This algorithm is essentially, as PSO and GA, a population-based heuristic search technique, which can be used to solve combinatorial optimization problems, modeled on the concepts of natural selection and evolution (GA) but also based on cultural and social rules derived from the analysis of the swarm intelligence and from the interaction among particles (PSO). Preliminary analyses are here presented with respect to the other optimization techniques dealing with a classical optimization problem. The optimized design of a printed reflectarray antenna is finally reported with numerical results.

(Fig. 11, Tab. 1, Ref. 16 – original in english) *Authors*

evolutionary optimization
hybridization strategies
reflectarray antennas

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MIMO PERFORMANCE GAINS – A SIGNAL PROCESSING POINT OF VIEW

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In order to wisely use the degrees of freedom which a multi-input multi-output (MIMO) offers, it is necessary to identify and quantify the possible gains in performance one can expect from MIMO signal processing. In this paper, we derive measures which allow to quantify the amount of antenna gain, diversity gain, and multiplexing gain of a MIMO system. It turns out that it is impossible to maximize all three gains, or any pair of two gains at the same time. The necessary trade-off between performance gains is demonstrated.

(Fig. 3, Ref. 19 – original in english) *Authors*

MIMO peformance measures
antenna gain
diversity gain
multiplexing gain

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ULTRA WIDEBAND DIPOLE ANTENNA OPTIMIZATION

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This paper describes optimization of the planar ultra wideband dipole antennas, which are optimized for perfect matching and perfect impulse radiation characteristics. The optimization of the dipole shapes starts from the classical wideband dipoles, especially from elliptical and diamond shapes. These wideband dipoles have been analyzed and optimized with unsatisfactory parameters performance. This paper proposes two optimized dipole structures fulfilling required parameters. Designed antennas could be used as an impulse-shaping filter for forming of transmitted UWB impulse.

(Fig. 13, Tab. 1, Ref. 5 – original in english) *Authors*

antennas
ultra wideband
impulse radiation characteristic
elliptical dipole
diamond dipole

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REDUCTION OF THE MUTUAL COUPLING BETWEEN TWO PLANAR INVERTED-F ANTENNAS WORKING IN CLOSE FREQUENCY BANDS

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This paper presents a solution to reduce the mutual coupling between two Planar Inverted-F Antennas (PIFAs) working in close frequency bands: DCS1800 (1710-1880 MHz) and UMTS (1920-2170 MHz). The antennas are positioned on the top corner of a ground plane whose size is representative of the Printed Circuit Board (PCB) of a typical mobile phone. Two antenna-systems are designed and several arrangements are studied, especially when suspended line is inserted between the radiators. This line is intended to act as a neutralization device and then reduce the mutual coupling. Several prototypes are fabricated and measured to validate the proposed solution.

(Fig. 11, Ref. 11 – original in english) *Authors*

planar inverted-F antennas (PIFAs)
small antennas
mutual coupling
isolation
mobile phone
efficiency

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Prethodno priopćenje

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DVOSLOJNI PLANARNI METAMATERIJALI S UZEMLJENOM RAVNINOM KOJI PODRŽAVAJU CUREĆE ELEKTROMAGNETSKE VALOVE – PRINCIPI I PRIMJENE

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U članku je dana analiza dvoslojnih planarnih metamaterijala s uzemljenom ravninom koji podržavaju cureće elektromagnetske valove. Nedavno predložene primjene ovakvih metamaterijala obuhvaćaju kompaktne antene s curećim valom i tanke planarne prekrivne strukture za povećanje efikasnosti prijenosa elektromagnetske energije kroz vrlo male otvore (otvori čije su dimenzije mnogo manje od valne duljine) u zaslonima načinjenim od idealnih vodiča. Takvi dvoslojni metamaterijali podržavaju pojavu rezonancije na sučelju materijala s komplementarnim dielektričnim (ili magnetskim) svojstvima kao i efekt fokusiranja kod materijala s malim vrijednostima realnog dijela permitivnosti i/ili permeabilnosti. Koristeći ove neuobičajne elektromagnetske pojave moguće je konstruirati otvorenu višeslojnu strukturu za vođenje elektromagnetskog vala čija je debljina mnogo manja od valne duljine. U članku su analizirana glavna svojstva neuobičajnih elektromagnetskih modova s curećim valom i istražena povezanost fizikalnih temelja dviju predloženih primjena.

(Sl. 5, Lit. 16 – original na engleskom) *Autori*

metamaterijali
cureći elektromagnetski valovi

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Stručni članak

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OBRAZOVANJE NA PODRUČJU ANTENA, RASPROSTIRANJA VALOVA I MIKROVALOVA

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Rad je usredotočen na učenje »primijenjenih mikrovalova«. Pozornost je okrenuta antenama, ali se ista struktura obrazovnog procesa može primijeniti na rasprostiranje radijskih valova, mikrovalove, elektromagnetsku kompatibilnost i druge elektromagnetske sadržaje. Struktura obrazovanja osniva se na odgovarajućoj teoriji popraćenoj simulacijama na računalu, teorijskom i inženjerskim proračunima i razvoju, mjerenjima i konačnoj provjeri, koja djeluje kao povratna veza između početnih ciljeva i konačnih rezultata. Utvrđena je važna uloga laboratorijskih eksperimenata temeljenih na fleksibilnim eksperimentalnim modelima i spomenuta mogućnost učenja na daljinu.

(Sl. 6, Lit. 13 – original na engleskom) *Autori*

antene
elektromagnetsko polje
obrazovanje
modeliranje
učenje

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POJEDNOSTAVLJENJE ODREĐIVANJA POLOŽAJA RAVNINE SVJETLA ZA VRIJEME SKENIRANJA STRUKTURIRANIM SVJETLOM

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Primjena tzv. strukturiranog svjetla (SL) je vrlo popularna metoda kod 3D rekonstrukcije. Jedna od jednostavnijih implementacija SL-a obuhvaća projiciranje uskog tamnog (svijetlog) vertikalnog »prozora« na svijetloj (tamnoj) pozadini pomoću videoprojektora. Zbog projiciranja tzv. ravnine svjetla udaraju u pojedine točke u prostoru i položaj tih ravnina je preduvjet za 3D triangulaciju dotične točke. Tradicionalni pristup triangulaciji zahtijeva i kalibraciju 3D videoprojektora. Ovaj rad predlaže metodu gdje se do položaja ravnina dolazi bez eksplicitne kalibracije videoprojektora. Usporedba tradicionalnog pristupa i predložene metode pokazala je da nema razlike po pitanju točnosti 3D rekonstrukcije. Međutim, dvije prednosti predložene metode su kao prvo da korisnik može jednostavnije i brže prijeći na uporabu sustava za neposrednu 3D rekonstrukciju. I kao drugo, sama implementacija sustava je jednostavnija, posebice u softverskom smislu. Konačno, demonstrirana je uspješna uporaba predloženog sustava (metode) za jednu aplikaciju u računalnoj grafici.

(Sl. 9, Tab. 2, Lit. 18 – original na engleskom) *Autori*

strukturirano svjetlo
kalibracija videoprojektora
3D rekonstrukcija

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MJERENJE FREKVENCIJSKOG ODZIVA SLUŠNOG POMAGALA POMOĆU SLOŽENOG AUDIO TEST SIGNALA

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U članku je opisana primjena složenog audio test signala (CATS) pri određivanju elektroakustičkih svojstava slušnih pomagala. Test sustav primjenjuje frekvencijski ugođenu CATS sekvenciju kao akustičku pobudu za mjerenje akustičkog odziva slušnog pomagala u stimulatoru po IEC standardu. Frekvencijski odziv se dobiva iz impulsnog odziva pomoću diskretne Fourierove transformacije. Ta metoda (CATS) ima znatne prednosti spram uobičajene mjerne metode sa šumnim signalom, pri mjerenju u prisutnosti ili odsutnosti vanjskog interferirajućeg šuma.

(Sl. 8, Lit. 14 – original na engleskom) *Autori*

složeni audio test signal
slušno pomagalo
akustička mjerenja

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Professional paper

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EDUCATION IN ANTENNAS, WAVE PROPAGATION AND MICROWAVES

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The paper is focused on teaching of »applied microwaves«. Attention is turned to antennas, but the same structure of education process is possible to apply for e.g. radio-wave propagation, microwaves, EMC, and other »electromagnetic topics« in their whole. The structure of the education is based on the appropriate amount of the theory followed by the computer simulations, the theoretical and engineering design and development, the measurement and final evaluation, which acts as the feedback between the initial goals and the final results. Important role of laboratory experiments based on flexible experimental set-ups is introduced and the possibility of distant (internet) laboratory excess is mentioned.

(Fig. 6, Ref. 13 – original in english) *Authors*

antennas
electromagnetic field
education
modeling
teaching

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Preliminary communication

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METAMATERIAL GROUNDED PLANAR BILAYERS SUPPORTING LEAKY WAVES: PRINCIPLES AND APPLICATIONS

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In this contribution, we review the analysis of metamaterial grounded planar bilayers supporting leaky-waves, which we have recently proposed elsewhere as compact sub-wavelength leaky-wave radiators, and for enhancing the wave transmission through apertures over conducting screens when used as covers. Exploiting the peculiar resonances arising when »complementary« or »conjugate« metamaterials are paired, together with the focusing properties of low-permittivity and/or low-permeability materials, it is possible to operate a sub-wavelength open wave-guide consisting of a stack of grounded metamaterial bilayers in the leaky-wave regime. We recall the salient guidance and radiation properties of these anomalous natural modes, providing some physical insights into the phenomenon and speculating on the connections between these two potential applications.

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metamaterials
leaky-waves

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Original scientific paper

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FREQUENCY RESPONSE MEASUREMENTS OF HEARING AIDS BASED ON COMPOSED AUDIO TEST SIGNAL

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This paper describes the implementation of composed audio test signal (CATS) based test system for evaluation of electroacoustic performance of hearing aids. The system applies a frequency-shaped CATS sequence to a hearing aid as an acoustic stimulus and measures the acoustic response of the aid in IEC standard occluded-ear stimulator. The frequency response can then be found by taking the discrete Fourier Transform of the impulse response. This method has several advantages over traditional noise-based methods regard measurements in the absence or presence of the external interference noise.

(Fig. 8, Ref. 14 – original in english) *Authors*

composed audio test signal – CATS
hearing aid
acoustical measurements

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SIMPLIFIED LIGHT PLANE DETERMINATION DURING STRUCTURED LIGHT SCANNING

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Structured light illumination is a widely spread approach for 3D shape reconstruction. Scanning the scene of interest with hard edge stripe via video projector is a very common implementation. During the scanning light planes are being projected across the space and their positions in time are needed to triangulate 3D position of some point. Traditionally, light plane equation is readily obtained in case of calibrated video projector. This paper presents a method where light plane positions are determined without explicit projector calibration. The comparison of traditional and proposed method showed no difference in terms of reconstruction accuracy. However, there are two major advantages of proposed method: end user can faster start using the system itself and system implementation is easier primarily in software sense. Also, successful method implementation for computer graphic application is shown.

(Fig. 9, Tab. 2, Ref. 18 – original in english) *Authors*

structured light
video projector calibration
3D reconstruction

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PLANIRANJE VoIP/PSTN MREŽA PRIMJENOM PROGRAMSKOG PAKETA PlanVoip

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U ovom radu opisana je IP mreža kao podloga za prijenos govorne usluge, te parametri koji utječu na razinu kvalitete usluge pri prijenosu govora IP mrežom. Od svih parametara, naglasak je dan na komponente kašnjenja, a poglavito na varijabilne komponente kašnjenja. U nastavku rada je opisan programski paket kojeg smo razvili u svrhu planiranja i analize VoIP/PSTN mreža. Na kraju su provedena simulacijska mjerenja s razvijenim programskim paketom pri čemu je analiziran utjecaj izabranog kodeka i kapaciteta linije na subjektivnu ocjenu kvalitete govora (MOS) i na ukupno kašnjenje govornih paketa. U svrhu verifikacije razvijenog programa provedena je i poredbena analiza rezultata simulacijskih mjerenja i mjerenja na stvarnoj mreži.

(Sl. 11, Tab. 3, Lit. 12 – original na engleskom) *Autori*

gubitak paketa
IP telefonija
kodek
programski paket PlanVoip
subjektivna (MOS) ocjena
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VoIP/PSTN NETWORKS PLANNING WITH PlanVoip APPLICATION

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The paper describes the IP network as a basis for the voice services transfer and parameters which influence the quality services level in the voice transfer over the IP network. Among all parameters, the accent is given on delay components, special on variable components. Hereafter is described the application which we have developed for the purpose of the VoIP/PSTN network planning and analyzing. At the end, testing measurements with the developed application are made whereat the influence of the used codec and the link capacity on the subjective score of voice quality (MOS) and on the total delay of voice packet is analyzed. For the purpose of the developed application verification, a comparison analysis of the testing measurements and measurements on the real network is carried out.

(Fig. 11, Tab. 3, Ref. 12 – original in english) *Authors*

packet loss
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total delay

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